REMARKS

Claims 1-59 are pending of which claims 1, 13, 24, 28, 41, 42, and 53 are independent. No claims have been amended, added or deleted.

Claim Rejections Pursuant to 35 U.S.C. §102(b)

Claim 1-59 were rejected as being anticipated by Bachtold et al ("An Error Indicator and Automatic Adaptive Meshing for Electrostatic Boundary Element Simulations", December 1997, IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems, Volume 16, Issue 12, Pages 1439-1446, hereafter "Bachtold"). For the reasons set forth below, these rejections are respectfully traversed.

Summary of Claimed Invention

The claimed invention utilizes a schematic design of a system-level model of a multi-physics device such as a MEMS device that is suitable for system-level simulations. The schematic includes a network of geometric and non-geometric components such as mechanical beams, rigid and/or flexible plates, electrodes, magnetic coils, lasers, electrodes, voltage sources, charge sources, force sources, applied pressure, etc., each of which has an underlying mathematical description, or behavioral model. For example, a behavioral model of the capacitance between two flat plates may be represented as a function of the distance between the plates and their area. The fringing fields at the edges of the plates may or may not be included in the behavioral model. A mesh generation tool automatically generates a mesh from the schematic for use in a PDE solver. The generated mesh may be for a BEM solver and/or a FEM solver. Each component in the system model has an associated mesh generator that knows how to generate a volumetric and/or surface mesh that represents the geometry of that component. The mesh generation tool blends together the meshes of the individual components to produce a volumetric and/or surface mesh that is suitable for a PDE solver.

Summary of Bachtold

Bachtold discusses a method for automatic adaptive meshing for electrostatic boundary element simulations. The starting point for the method is clearly stated to be a "coarse initial discretization", e.g. a solid model. It will be appreciated that the initial discretization is already a geometric representation of the surfaces that define boundaries between different materials, or between materials and a surrounding fluid material such as air. Furthermore, this initial discretization represents the entire geometry to be solved – there is no distinction made between different parts of the geometry that may serve different functions. The boundary element method (BEM) is one of a class of numerical techniques for solving a system of partial differential equations and may therefore be classified as a PDE solver or field solver, because it solves for a field that varies in space. The BEM has the particular property that only the interfaces between materials must be discretized into smaller regions called panels, and on each panel there is one or more collocation points where the solver computes the value of the field. The collection of such panels is referred to as a surface mesh. The focus of Bachtold is a method that adaptively refines the size and shape of the surface panels until the numerical field solution converges to a desired level of accuracy.

Argument

The Examiner relies on Bachtold et al to reject independent claims 1, 13, 24, 28, 41, 42 and 53. Applicants respectfully traverse the rejections.

Each of Applicants' independent claims 1, 13, 24, 28, 41, 42 and 53 includes the claim element of a schematic design suitable for system-level simulation. This schematic design includes geometric and non-geometric components which are each associated with a mesh generator. A mesh generation tool utilizes the mesh generators to generate a mesh for each component. The individual meshes are then combined into a complete mesh that represents the MEMS device or a sub-assembly of the device. As noted in the specification, "The direct use of the schematic avoids the loss of data that would follow from generating the mesh from a 2D

mask layout or 3D CAD solid model derived from the schematic" (see page 6, lines 9-11)[emphasis added].

In contrast, the Bachtold system does generate the mesh from a solid model. "Starting from a coarse initial discretization, the method automatically constructs an optimal mesh..." (see page 1446, paragraph 2 beginning at fourth line of paragraph). "A scheme is presented which allows generating an optimal mesh automatically based on a coarse initial discretization, e.g. a CAD model"(see Bachtold Abstract). A solid model is a geometric construction that represents a collection of volume-filling parts in a form suitable for computer processing. Each part is defined by a collection of surfaces that enclose the part's volume. The surfaces are represented by analytical mathematical formulae, numerical splines, flat facets and/or other mathematical or numerical means. As noted above, this initial discretization is already a geometric representation of the surfaces that define boundaries between different materials, or between materials and a surrounding fluid material such as air. Furthermore, this initial discretization represents the entire geometry to be solved – there is no distinction made between different parts of the geometry that may serve different functions. In contrast, the schematic representation includes both geometric and non-geometric components.

Applicants independent claims also require the use of mesh generators associated with each component in the schematic. Bachtold fails to disclose this element. The Examiner generally cited Figure 11 and a discussion on pages 1445 and 1446 (for a number of claim elements) which the Examiner suggested discussed the automatic generation of an initial mesh for each area within a CAD environment using a modeling program. Even assuming the Examiner's summary was correct, the use of a modeling program to generate a mesh for separate areas of a model does not disclose the claim elements of discrete mesh generators associated with each schematic component. The claimed invention and Bachtold are substantially different as Applicants' claimed invention proceeds from a schematic representation which avoids a loss of data while Bachtold proceeds from the mesh of a solid model and then refines the mesh.

Accordingly, as Bachtold fails to disclose all of the claim elements of Applicants independent claims as required to sustain a rejection under 35 U.S.C. §102, Applicants request the allowance of claims 1-59.

Although Applicants feel the claims are all in condition for allowance based on the reasons set forth above, Applicants also wish to note some additional arguments. The Examiner rejected, claims 3, 15, 30, 44 and 56 which indicate that the system-level simulation environment is one of a circuit simulation environment and a signal flow simulation environment by citing the abstract's discussion of "simulations involving complex geometries with various dielectric materials, conductors." Bachtold makes no mention of either system-level simulations, circuit simulations or signal flow simulations and it will be appreciated that the BEM approach discussed in Bachtold (and the abstract) is not applicable to those types of simulations.

The Examiner rejected claims 4, 16, 25, 31, 45, 57, 58 and 59 asserting that the generation of a mesh for each component and the subsequent combining of these individual component meshes into a single mesh is the equivalent to the adaptive optimization of a single mesh in Bachtold. As previously noted, Bachtold operates on a single mesh, which is then adaptively optimized. The use of a single mesh does not disclose Applicants claim limitations requiring individual component meshes which are combined.

Applicants also wish to note in passing that the inventors are personally familiar with the work of Bachtold and it is directed to a separate problem. Martin Bachtold was an employee of Coyote Systems, Inc. at the time Bachtold was published. The Assignee of Applicants invention, and the inventors' employer, Coventor, Inc., acquired Coyote Systems Inc. in May 2000. Martin Bachtold was subsequently a colleague of the inventors, from August 2000 through January 2004, a time period which included the filing date of the instant application. The Applicants' Assignee accordingly already had the rights to the Bachtold invention and would not have needed to pursue the current application if Applicants' claimed invention was directed to the same problem and worked in the same manner. Bachtold is directed to a different problem and works in a different manner than Applicants' claimed invention.

CONCLUSION

In view of the above, Applicants believe the pending application is in condition for allowance.

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Respectfully submitted,

By [signature]

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